Package: npmlda (via r-universe)

August 23, 2024

Type Package

Title Non-Parametric Models for Longitudinal Data Analysis

Version 1.2.0

Date 2018-06-14

Author Xin Tian, Colin Wu

Maintainer Xin Tian <tianxtt@gmail.com>

Description Support the book: Wu CO and Tian X (2018). Nonparametric Models for Longitudinal Data: With Implementation in R. (Chapman & Hall/CRC Monographs on Statistics & Applied Probability); Present global and local smoothing methods for the conditional-mean and conditional-distribution based nonparametric models with longitudinal Data.

License GPL (>= 2)

BugReports https://github.com/npmldabook/npmlda/issues

URL https://github.com/npmldabook/npmlda/

https://www.crcpress.com/Nonparametric-Models-for-Longitudinal-Data-With-Implementation-in-R/Wu-Tian/p/book/9781466516007

Encoding UTF-8

LazyData true

Depends R (>= 3.0)

Imports splines

RoxygenNote 6.0.1

Repository https://npmldabook.r-universe.dev

RemoteUrl https://github.com/npmldabook/npmlda

RemoteRef HEAD

RemoteSha 445f2085b5e12c4109910b3880d27f63407db8ac

Contents

`BDIdata` *BDIdata dataset*

Description

This dataset includes 557 depressed patients (total 7117 observations) in the cognitive behavior therapy arm in the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) study.

Usage

```
data(BDIdata)
```

Format

A data frame with 7117 rows and 5 variables.

Details

- ID. Subject ID
- time. Study visit time (in days) since randomization
- BDI. Beck Depression Inventory (BDI) score
- med. Antidepressant medication use
- med.time. The starting time of medication

References

1. Wu, C. O., Tian, X. and Bang, H. A varying-coefficient model for the evaluation of time-varying concomitant intervention effects in longitudinal studies. Statistics in Medicine, 27:3042-3056, 2008.
2. Wu, C. O., Tian, X. and Jiang, W. A shared parameter model for the estimation of longitudinal concomitant intervention effects. Biostatistics, 12(4):737-749, 2011.

`BMACS` *BMACS CD4 dataset*

Description

This dataset is from the Baltimore site of the Multi-center AIDS Cohort Study (BMACS), which included 400 homosexual men who were infected by the human immunodeficiency virus (HIV) between 1984 and 1991.

Usage

```
data(BMACS)
```

Format

A data frame with 1817 rows and 6 variables.

Details

- ID. Subject ID
- Time. Subject's study visit time
- Smoke. Cigarette baseline smoking status
- age. Age at study enrollment
- preCD4. Pre-infection CD4 percentage
- CD4. CD4 percentage at the time of visit

References

Kaslow, R. A., Ostrow, D. G., Detels, R., Phair, J. P., Polk, B. F. and Rinaldo, C. R. The Multi-center AIDS Cohort Study: rationale, organization and selected characteristics of the participants. American Journal of Epidemiology, 126:310-318, 1987.

`CVlm` *Leave one-subject out Cross-validation score for local linear fit*

Description

Leave one-subject out Cross-validation score for local linear fit

Usage

```
CVlm(Xvec, Yvec, bw, ID, Wt)
```

Arguments

`Xvec, Yvec`	numeric vectors of data values, Xvec and Yvec must have the same length.
`bw`	a bandwidth of the Epanechnikov kernel
`ID`	subject ID of the data value
`Wt`	a weight vector, may be subject-specific. a weight vector or a constant. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

`CVspline` *Leave one-subject out Cross-validation score for spline fit*

Description

Leave one-subject out Cross-validation score for spline fit

Usage

```
CVspline(Xvec, Yvec, ID, nKnots, Degree, Wt)
```

Arguments

`Xvec, Yvec`	numeric vectors of data values, Xvec and Yvec must have the same length.
`ID`	subject ID of the data value
`nKnots`	number of equally-spaced knots
`Degree`	degree of polynomial splines
`Wt`	a weight vector. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

DXi *Derivative of the function Xi(s)*

Description

Derivative of the function Xi(s)

Usage

```
DXi(s)
```

Arguments

s	a number or a vector

Value

value of the function DXi with give s

Examples

```
DXi(c(-1000, -10,-5, 0, 5,10, 1000 ))
```

HSCT *HSCT dataset*

Description

This dataset consists of 20 patients with hematologicmalignancies who had allogeneic hematopoietic stem cell transplantation (HSCT) between 2006 and 2009 at the National Institutes of Health (NIH). The variables are as follows:

Usage

```
data(HSCT)
```

Format

A data frame with 271 rows and 8 variables.

Details

- ID. Subject ID
- Days. Subject's study visit time relative to time of transplant (day 0)
- Granu. Granulocytes (K/uL)
- LYM. Lymphocytes (K/uL)
- MON. Monocytes (K/uL)
- G-CSF. Granulocyte colony-stimulating factor level (pg/mL)
- IL-15. IL-15 level (pg/mL)
- MCP-1. monocyte chemotactic protein-1 level (pg/mL)

References

Melenhorst, J.J., Tian, X., Xu, D., Sandler, N.G., Scheinberg, P., Biancotto, A., et al. Cytopenia and leukocyte recovery shape cytokine fluctuations after myeloablative allogeneic hematopoietic stem cell transplantation. Haematologica, 97(6):867-73, 2012.

`kernel.fit` *Nadaraya-Watson Kernel estimator*

Description

Nadaraya-Watson Kernel estimator

Usage

```
kernel.fit(Xint, Xvec, Yvec, bw, Kernel = "Ep", Wt = 1)
```

Arguments

`Xint`	a vector of x interval to generate the local linear fit
`Xvec, Yvec`	numeric vectors of data values, Xvec and Yvec must have the same length.
`bw`	a bandwidth of the kernel
`Kernel`	a character string indicating which kernel function is to be used. Use of "Ep", "Bw", or "Nm" for Epanechnikov, Biweight or Normal kernel function.
`Wt`	a weight vector

References

1. Fan, J. and Gijbels, I. Local Polynomial Modeling and Its Applications. Chapman & Hall, London, United Kingdom, 1996.
2. Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018

Examples

```
X <- seq(0, 1, len=100)
Y <- (X- 0.5)^3 - 2*(X-0.5)^2+ rnorm(100, 0, 0.1)
kernel.fit(seq(0,1,0.1), X, Y, Kernel="Ep", bw=0.1, Wt=1   )
```

`Kernel2D` *2-dim Kernel function for longitudinal data*

Description

2-dim Kernel function for longitudinal data

Usage

```
Kernel2D(IDls, Xvec, Yvec, X01, X02, Bndwdth1, Bndwdth2)
```

Arguments

`IDls`	the vector of subject ID in a longitudinal sample
`Xvec`	Yvec numeric vectors of data values, Xvec and Yvec must have the same length
`X01`	X02 two given values of Xvec
`Bndwdth1, Bndwdth2`	two given bandwidths

Value

2-dim kernel fit result

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

`Kernel3D` *3-dim Kernel function for longitudinal data to get Pr(y1(t1),y2(t2)|x(t1))*

Description

3-dim Kernel function for longitudinal data to get Pr(y1(t1),y2(t2)|x(t1))

Usage

```
Kernel3D(IDls = ID, Y, Time, X, T1, T2, X0, Bndwdth1, Bndwdth2, Bndwdth3)
```

Arguments

`IDls`	the vector of subject ID in a longitudinal sample
`Y, X, Time`	numeric vectors of outcome, covariate and time of the the same length
`T1, T2`	twp given time points
`X0`	a given covariate value
`Bndwdth1, Bndwdth2, Bndwdth3`	three bandwidths around two time and one covariate value

Value

3-dim Kernel function results

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

`Kernel3D.S2` *3-dim Kernel function for longitudinal data to get Pr(y2(t2)|x(t1))*

Description

3-dim Kernel function for longitudinal data to get Pr(y2(t2)|x(t1))

Usage

```
Kernel3D.S2(IDls = ID, Y, Time, X, T1, T2, X0, Bndwdth1, Bndwdth2, Bndwdth3)
```

Arguments

`IDls`	the vector of subject ID in a longitudinal sample
`Y, X, Time`	numeric vectors of outcome, covariate and time of the the same length
`T1, T2`	twp given time points
`X0`	a given covariate value
`Bndwdth1, Bndwdth2, Bndwdth3`	three bandwidths around two time and one covariate value

Value

3-dim Kernel function results

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

`Kh.Bw` *Biweight kernel*

Description

Biweight kernel

Usage

```
Kh.Bw(datavec, Bndwdth)
```

Arguments

`datavec`	a numeric vector
`Bndwdth`	a bandwidth of the kernel

Value

kernel function result

Examples

```
# same usage as Kh.Ep
```

`Kh.Ep` *Epanechnikov Kernel*

Description

Epanechnikov Kernel

Usage

```
Kh.Ep(datavec, Bndwdth)
```

Arguments

`datavec`	a numeric vector
`Bndwdth`	a bandwidth

Value

kernel function result

Examples

```
Kh.Ep(2:7,5)
```

`Kh.Nm` *Normal kernel*

Description

Normal kernel

Usage

```
Kh.Nm(datavec, Bndwdth)
```

Arguments

`datavec`	a numeric vector
`Bndwdth`	a bandwidth of the kernel

Value

kernel function result

Examples

```
Kh.Nm(2:7,5)
```

`Kh2D` *Multiplicative Epanechnikov Kernel (2-dim)*

Description

Multiplicative Epanechnikov Kernel (2-dim)

Usage

```
Kh2D(datavec1, datavec2, Bndwdth1, Bndwdth2)
```

Arguments

`datavec1`	datavec2 two numeric vectors of same length
`Bndwdth1`	Bndwdth2 two bandwidths for two vectors

Value

2-dim kernel function result

Examples

```
Kh2D(2:7, 2:7, 5, 5)
```

Kh3D *Multiplicative Epanechnikov Kernel (3-dim)*

Description

Multiplicative Epanechnikov Kernel (3-dim)

Usage

```
Kh3D(datavec1, datavec2, datavec3, Bndwdth1, Bndwdth2, Bndwdth3)
```

Arguments

datavec1	datavec2, datavec3 three numeric vectors of same length
Bndwdth1	Bndwdth2, Bndwdth3 three bandwidths for three vectors

Value

3-dim kernel function result

LocalLm *Local linear fit with Epanechnikov kernel*

Description

Local linear fit with Epanechnikov kernel

Usage

```
LocalLm(Xint, Xvec, Yvec, bw, Wt = 1)
```

Arguments

Xint	a vector of x interval to generate the local linear fit
Xvec, Yvec	numeric vectors of data values, Xvec and Yvec must have the same length.
bw	a bandwidth of the kernel
Wt	a weight vector

Examples

```
data(BMACS)
Time.int<- seq(0.1,5.9,  by=0.1)
LocalFit.Y <- with(BMACS, LocalLm(Time.int, Time, CD4, bw=0.9, Wt=1))
```

LocalLm.Beta *Least square local linear fit*

Description

Least square local linear fit

Usage

```
LocalLm.Beta(Tint, Tvec, X1, X2, X3, Yvec, Bndwdth, Weight)
```

Arguments

Tint	a time interval
Tvec, Yvec	numeric vectors of time and outcome values, Tvec and Yvec must have the same length.
X1, X2, X3	three covariate vectors
Bndwdth	a bandwidth of the Epanechnikov kernel
Weight	the weight vector

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

Examples

```
data(NGHS)
NGHS$Black <- (NGHS$RACE==2)*1
NGHS<- NGHS[!is.na(NGHS$SBP) & !is.na(NGHS$BMIPCT) & !is.na(NGHS$HTPCT ),]
Ct <-   data.frame(table(NGHS$ID))
names(Ct)<- c('ID', 'ni')
NGHS<- merge(NGHS, Ct, by= 'ID')
nID<- dim(Ct)[1]
Age.grid <- seq(9, 19, by=0.5) #21
NGHS$HTPCTc<- NGHS$HTPCT-50
NGHS$BMIPCTc<- NGHS$BMIPCT-50
Beta <- with(NGHS, LocalLm.Beta(Age.grid, AGE, X1=Black, X2=HTPCTc, X3=BMIPCTc, SBP, Bndwdth=3.5, Weight=1/ni))
```

`LocalLm.Beta.t0` *Least square local linear fit at t0*

Description

Least square local linear fit at t0

Usage

```
LocalLm.Beta.t0(t0, Tvec, X1, X2, X3, Yvec, Bndwdth, Weight)
```

Arguments

`t0`	a given time point
`Tvec, Yvec`	numeric vectors of time and outcome values, Tvec and Yvec must have the same length.
`X1, X2, X3`	three covariate vectors
`Bndwdth`	a bandwidth of the Epanechnikov kernel
`Weight`	the weight vector

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

Examples

```
# see usage of LocalLm.Beta
```

`LocalLm.X0` *Local linear fit at X0 with Epanechnikov kernel*

Description

Local linear fit at X0 with Epanechnikov kernel

Usage

```
LocalLm.X0(Xvec, Yvec, X0, Bndwdth, Wt = 1)
```

Arguments

Xvec, Yvec	numeric vectors of data values, Xvec and Yvec must have the same length.
X0	a given value
Bndwdth	a bandwidth of the kernel
Wt	a weight vector or a constant. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

Examples

```
# see usage of LocalLm
```

Newton1var — *An equation solver with Newton's method with 1 variable*

Description

An equation solver with Newton's method with 1 variable

Usage

```
Newton1var(Z12vec, h0, Vh, HZB, Ind.Y, Diff = 1e-08, ORR, MaxIter = 100)
```

Arguments

Z12vec	2-dim covariate vector
h0, Vh, HZB	inital values
Ind.Y	outcome inidicator
Diff	limit to stop the interations
ORR	estimate of the odds ratio vector
MaxIter	maximum no. of interations

Value

The root of the equation

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

Newton2var *An equation solver with Newton's method with 2 variables*

Description

An equation solver with Newton's method with 2 variables

Usage

```
Newton2var(Zij, b0, Ub, Indicator, difflmt = 1e-14, MaxIter = 100)
```

Arguments

`Zij`	2-dim covariate vector
`b0, Ub`	inital values
`Indicator`	Indicator of Yi1> Yi2
`difflmt`	limit to stop the interations
`MaxIter`	maximum no. of interations

Value

The root of the equation

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

NGHS *NGHS dataset*

Description

This dataset includes 2378 girls (total 19701 observations) enrolled in the National Heart, Lung, and Blood Institute's Growth and Health Study (NGHS). NGHS is a multicenter population-based cohort study aimed at evaluating the racial differences and longitudinal changes in childhood cardiovascular risk factors between Caucasian and African American girls during childhood and adolescence.

Usage

```
data(NGHS)
```

Format

A data frame with 19701 rows and 12 variables.

Details

- ID. Subject ID
- RACE. Subject's race (1=Caucasian, 2= African American)
- AGE,HEIGHT,WEIGHT,BMI. Age, height, weight and BMI at study visit
- BMIPCT, HTPCT. CDC Age-adjusted BMI percentile and height percentile at study visit
- SBP,DBP. Systolic and diastolic blood pressure at study visit
- TG,LDL. Triglyceride and Low-density lipoprotein (LDL) cholesterol at study visit

References

1. National Heart, Lung, and Blood Institute Growth and Health Research Group (NGHSRG). Obesity and cardiovascular disease risk factors in black and white girls: the NHLBI Growth and Health Study. American Journal of Public Health, 82:1613-1620, 1992.
2. Wu, C. O. and Tian, X. Nonparametric estimation of conditional distributions and rank-tracking probabilities with time-varying transformation models in longitudinal studies. Journal of the American Statistical Association, 108:971-982, 2013.

`NW.Kernel` *Title Nadaraya-Watson Kernel estimator at x0*

Description

Title Nadaraya-Watson Kernel estimator at x0

Usage

```
NW.Kernel(Xvec, Yvec, X0, Kernel = "Ep", Bndwdth, Wt = 1)
```

Arguments

`Xvec, Yvec`	numeric vectors of data values, Xvec and Yvec must have the same length.
`X0`	a given value
`Kernel`	a character string indicating which kernel function is to be used. Use of "Ep", "Bw", or "Nm" for Epanechnikov, Biweight or Normal kernel function.
`Bndwdth`	a bandwidth of the kernel
`Wt`	a weight vector or a constant. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

Value

The kernel estimator at x0

References

1. Fan, J. and Gijbels, I. Local Polynomial Modeling and Its Applications. Chapman & Hall, London, United Kingdom, 1996.
2. Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data. Chapman & Hall/CRC. To appear.

Examples

```
X <- seq(0, 1, len=100)
Y <- (X- 0.5)^3 - 2*(X-0.5)^2+ rnorm(100, 0, 0.1)
NW.WtKernel(X, Y,  X0=0.5, Kernel="Ep", Bndwdth=0.3, Wt=1 )
NW.WtKernel(X, Y,  X0=0.5, Kernel="Nm", Bndwdth=0.3, Wt=1 )
```

NW.WtKernel *Title Nadaraya-Watson Kernel estimator at x0*

Description

Title Nadaraya-Watson Kernel estimator at x0

Usage

```
NW.WtKernel(Xvec, Yvec, X0, Kernel = "Ep", Bndwdth, Wt = 1)
```

Arguments

Xvec, Yvec	numeric vectors of data values, Xvec and Yvec must have the same length.
X0	a given value
Kernel	a character string indicating which kernel function is to be used. Use of "Ep", "Bw", or "Nm" for Epanechnikov, Biweight or Normal kernel function.
Bndwdth	a bandwidth of the kernel
Wt	a weight vector or a constant. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

Value

The kernel estimator at x0

References

1. Fan, J. and Gijbels, I. Local Polynomial Modeling and Its Applications. Chapman & Hall, London, United Kingdom, 1996.
2. Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018

Examples

```
X <- seq(0, 1, len=100)
Y <- (X- 0.5)^3 - 2*(X-0.5)^2+ rnorm(100, 0, 0.1)
NW.WtKernel(X, Y,  X0=0.5, Kernel="Ep", Bndwdth=0.3, Wt=1 )
NW.WtKernel(X, Y,  X0=0.5, Kernel="Nm", Bndwdth=0.3, Wt=1 )
```

---

spline.fit *Polynomial-spline fit with equally-spaced knots*

Description

Polynomial-spline fit with equally-spaced knots

Usage

```
spline.fit(Xint, Xvec, Yvec, nKnots = 2, Degree = 3, Wt = 1)
```

Arguments

`Xint`	a vector of x interval to generate the local linear fit
`Xvec, Yvec`	numeric vectors of data values, Xvec and Yvec must have the same length.
`nKnots`	number of equally-spaced knots
`Degree`	degree of polynomial splines
`Wt`	a weight vector or a constant. For longitudinal data, Wt=1/N corresponds to measurement uniform weight and Wt=1/(nni) corresponds subject uniform weight.

References

Wu, C.O. and Tian, X. Nonparametric Models for Longitudinal Data: With Implementation in R. Chapman & Hall/CRC. 2018.

Xi *Function Xi(s)*

Description

Function Xi(s)

Usage

```
Xi(s)
```

Arguments

`s`	a number or a vector

Value

value of the function with give s

Examples

```
Xi(0)
Xi(c(-1000, -10,-5, 0, 5,10, 1000 ))
```

Index